(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 754 972 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.07.2014 Bulletin 2014/29

(51) Int Cl.:
F24F 12/00 *(2006.01)* ***F24F 13/10*** *(2006.01)*

(21) Application number: **13198161.5**

(22) Date of filing: **18.12.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **09.01.2013 IT TO20130009**

(71) Applicant: **Thesan S.p.A.**
10129 Torino (IT)

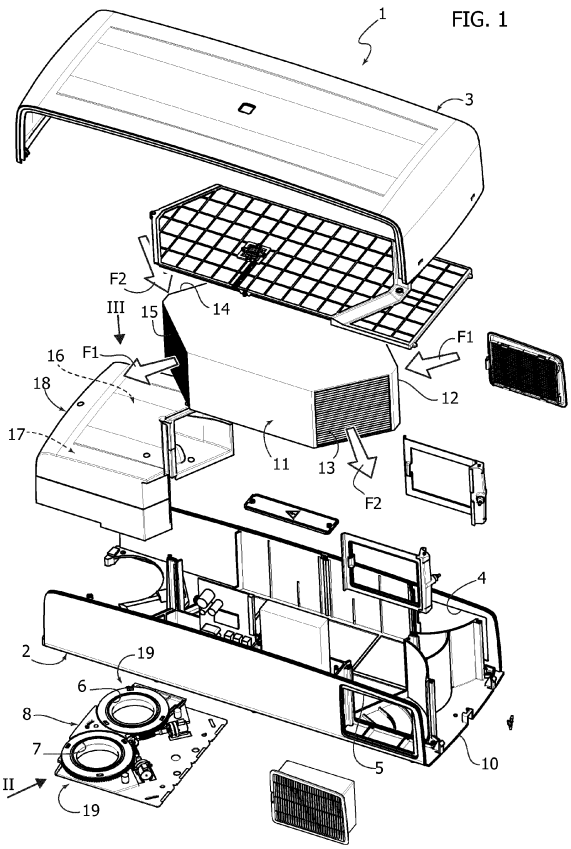
(72) Inventor: **Balbo di Vinadio, Aimone**
I-10050 Chiusa San Michele (Torino) (IT)

(74) Representative: **Marchitelli, Mauro**
Buzzi, Notaro & Antonielli d'Oulx Srl
Via Maria Vittoria 18
10123 Torino (IT)

(54) **Ventilation device for buildings equipped with a valve for opening and closing an aperture for the passage of an airflow**

(57) Air exchange device for buildings, comprising:
- a casing (2, 3) having an internal inlet opening (4), an internal outlet opening (5), an external inlet opening (6) and an external outlet opening (7),
- a heat exchanger (11) housed within said casing (2, 3) and having a first inlet (12) in communication with the internal inlet opening (4), a first outlet (15) in communication with the external outlet opening (7), a second inlet (14) in communication with the external inlet opening (6) and a second outlet (13) in communication with the internal outlet opening (5),
- a first fan unit (16) arranged for generating a first airflow (F1) directed from the internal inlet opening (4) towards the external outlet opening (7) and a second fan unit (17) arranged for generating a second airflow (F2) directed from the external inlet opening (6) towards the internal outlet opening (5), wherein the first and second airflows (F1, F2) are in a relationship of mutual heat exchange in said heat exchanger (11), and
- a valve device (8) including respective valve elements (19) for opening and closing the external inlet opening (6) and the external outlet opening (7), wherein each of said valve elements (19) comprises:
- a fixed crown gear (21),
- a rotatable crown gear (20),
- a flexible sleeve (22) having a first end (32) fastened to the fixed crown gear (21) and a second end (34) fastened to the rotatable crown gear (20), and
- an actuator (40) for controlling the rotation of the rotatable crown gear (20) with respect to the fixed crown gear (21) between an open position wherein the flexible sleeve (22) has essentially an annular shape and a closed position wherein the flexible sleeve (22) has essentially a diaphragm shape.

FIG. 1



EP 2 754 972 A1

Description

Field of the invention

[0001] The present invention relates to a ventilation device equipped with a valve for opening and closing an aperture for the passage of an airflow.

Description of the prior art

[0002] Ventilation devices for buildings are normally equipped with a first fan unit that generates a first airflow directed from the inside outwards and a second fan unit that generates a second airflow directed from the outside inwards. The two airflows are usually arranged in a relationship of mutual heat exchange within a heat exchanger, for the recovery of the thermal energy of the airflow directed outwards.

[0003] Air exchange devices of this type can be equipped with valve devices to close one or both of the apertures communicating with the outside of the building. The valve devices may envisage the use of movable partitions for the opening and closing of the apertures in communication with the external environment

[0004] The solutions that envisage a movable partition for opening and closing the apertures have a large footprint due to the need to provide a free space equal to the opening stroke of and closing the movable partitions.

Object and summary of the invention

[0005] The present invention aims to provide a ventilation device with a valve for opening and closing an aperture for the passage of an airflow, having a smaller footprint.

[0006] According to the present invention, this object is achieved by a device having the features forming the subject of claim 1.

[0007] The claims form an integral part of the disclosure provided in relation to the invention.

Brief description of the drawings

[0008] The present invention will now be described in detail with reference to the attached drawings, given purely by way of non-limiting example, wherein:

- Figure 1 is an exploded perspective view of a ventilation device according to the present invention,
- Figure 2 is a perspective view of a valve device indicated by the arrow II in Figure 1
- Figures 3 and 4 are perspective views illustrating the valve device of Figure 2 in a partially closed and fully closed condition, respectively,
- Figure 5 is a cross-section of the valve element indicated by the arrow V in Figure 2, and
- Figure 6 is an exploded cross-section of the valve element of Figure 5.

Description of embodiments

[0009] With reference to Figure 1, numeral 1 indicates an air exchange device for buildings according to the present invention. The device 1 comprises a casing including a base 2 and a lid 3, which can be made of rigid injection-molded plastic material.

[0010] The device 1 is intended to be mounted in an internal environment of a building in order to carry out air exchange with recovery of the airflow energy delivered to the outside. The device 1 is intended to be fixed on a perimetrical wall and communicates with the external environment by means of a pair of holes formed in the perimetrical wall.

[0011] The base 2 comprises an internal inlet opening 4, an internal outlet opening 5, an external inlet opening 6 and an external outlet opening 7. The external inlet opening 6 and the external outlet opening 7 communicate with the holes formed in the perimetrical wall.

[0012] The external inlet opening 6 and the external outlet opening 7 are associated with a valve device 8 configured to hermetically close the openings 6, 7.

[0013] The base 2 contains a heat exchanger 11 having a first inlet 12 in communication with the internal inlet opening 4, a first outlet 13 in communication with the internal outlet opening 5, a second inlet 14 in communication with the external inlet opening 6 and a second outlet 15 in communication with the external outlet opening 7.

[0014] The air exchange device 1 comprises a first fan unit 16 that generates a first airflow F1 directed from the internal inlet opening 4 towards the external outlet opening 7 and a second fan unit 17 that generates a second airflow F2 directed from the external inlet opening 6 towards the internal outlet opening 5. The first and second airflows F1, F2 are in a relationship of mutual heat exchange in the heat exchanger 11. In winter when the temperature of the internal environment is greater than the temperature of the external environment, the outwardly directed airflow F1 transfers heat to the inwardly directed airflow F2. In summer when the internal environment is conditioned and is at a lower temperature than the external temperature the outwardly directed airflow F1 cools the inwardly directed airflow F2.

[0015] In the illustrated example, the first and the second fan units 16, 17 are housed in an elastic support 18 in the form of cushion, equipped with seats for housing the fan units 16, 17 and ducts for the passage of the airflows F1 and F2.

[0016] With reference to Figures 2 to 6, the valve device 10 comprises a plate 9, for example of sheet metal, fixed to a bottom wall 10 of the base 2 (Figure 1).

[0017] The plate 9 has two openings 6, 7 for the passage of the airflows F1 and F2. A respective valve element 19 is associated with each opening 6, 7.

[0018] With reference to Figures 5 and 6, each valve element 19 comprises a fixed crown gear 21, a rotatable crown gear 20 and a flexible sleeve 22. The fixed crown

gear 21 and the rotatable crown gear 20 have respective openings 24, 26 aligned with each other and arranged alongside the respective openings 6, 7 of the plate 9. In the illustrated example the fixed crown gear 21 is fastened to a support 28 (Figures 2-4) in turn fastened to the plate 9. Preferably, the fixed crown gear 21 and the rotatable crown gear 20 are connected together by means of a threaded coupling 30, in such a way so that following the rotation of the rotatable crown gear 20 about the axis A, a relative axial displacement between the gears 21, 20 is also obtained.

[0019] The flexible sleeve 22 is constituted of a thin tubular-shaped film of flexible and elastic material, such as latex or the like. The sleeve 22 has two opposite ends, which are attached, respectively, to the fixed crown gear 21 and the rotatable crown gear 20. Preferably, the opposite ends of the flexible sleeve 22 are fixed to two o-rings 32, 34 that are inserted within the respective grooves 36, 38 formed in the fixed crown gear 21 and the rotatable crown gear 20.

[0020] With reference to Figures 1 to 3, each valve device 19 comprises an actuator 40 for controlling the rotation of the respective rotatable crown gear 20 about the axis A. In the example illustrated in the figures, the actuator 40 is an electric motor, which rotationally drives a worm screw 42 that engages with a helical gear 44 of the rotatable crown gear 20. However, other mechanisms for controlling the rotation of the rotatable crown gear 20 may be used. Position sensors associated with the rotatable crown gear 20 may also be provided and configured to stop the actuator 40 when the rotatable crown gear 20 reaches the open position and the closed position.

[0021] In the open position, illustrated in Figures 2 and 5, the flexible sleeve 22 has an annular shape and is adjacent to the edges of the openings 24, 26. In this condition the opening 6, 7 is open and allows the transit of an airflow.

[0022] To close the opening 6, 7, the rotatable crown gear 20 is rotationally driven about the axis A by means of the actuator 40. During the rotation of the rotatable crown gear 20, the two opposite ends of the flexible sleeve 22 rotate relative to one another. The flexible sleeve 22 consequently assumes a diaphragm shape as shown in Figures 3 and 4. Figure 3 illustrates a partially closed position and Figure 4 illustrates the fully closed position of the valve device 19.

[0023] The worm screw and helical gear transmission system is unidirectional so that the rotatable crown gear 20 is retained in a stable manner in the position that is reached. This also partially closed stable positions of the valve device 19.

[0024] The valve device 19 according to the present invention can be used in air exchange devices for buildings and in any other application where there is the need to completely or partially close a duct for the passage of an airflow.

[0025] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to those described and illustrated without departing from the scope of the invention as defined by the claims that follow.

Claims

1. Air exchange device for buildings, comprising:

- a casing (2, 3) having an internal inlet opening (4), an internal outlet opening (5), an external inlet opening (6) and an external outlet opening (7),
- a heat exchanger (11) housed inside said casing (2, 3) and having a first inlet (12) in communication with the internal inlet opening (4), a first outlet (15) in communication with the external outlet opening (7), a second inlet (14) in communication with the external inlet opening (6) and a second outlet (13) in communication with the internal outlet opening (5),
- a first fan unit (16) arranged for generating a first airflow (F1) directed from the internal inlet opening (4) towards the external outlet opening (7) and a second fan unit (17) arranged for generating a second airflow (F2) directed from the external inlet opening (6) towards the internal outlet opening (5), wherein the first and second airflows (F1, F2) are in a relationship of mutual heat exchange in said heat exchanger (11), and
- a valve device (8) including respective valve elements (19) for opening and closing the external inlet opening (6) and the external outlet opening (7),

characterized in that each of said valve elements (19) comprises:

- a fixed crown gear (21),
- a rotatable crown gear (20),
- a flexible sleeve (22) having a first end (32) fastened to the fixed crown gear (21) and a second end (34) fastened to the rotatable crown gear (20), and
- an actuator (40) for controlling the rotation of the rotatable crown gear (20) with respect to the fixed crown gear (21) between an open position wherein the flexible sleeve (22) has essentially an annular shape and a closed position wherein the flexible sleeve (22) has essentially a diaphragm shape.

2. Device according to claim 1, **characterized in that** the fixed crown gear (21) and the rotatable crown gear (20) are interconnected by means of a threaded coupling (30).

3. Device according to claim 1, **characterized in that** the ends of said flexible sleeve (22) are anchored to the respective o-rings (32, 34) that are inserted within respective grooves (36, 38) of the fixed crown gear (21) and the rotatable crown gear (20).

FIG. 1

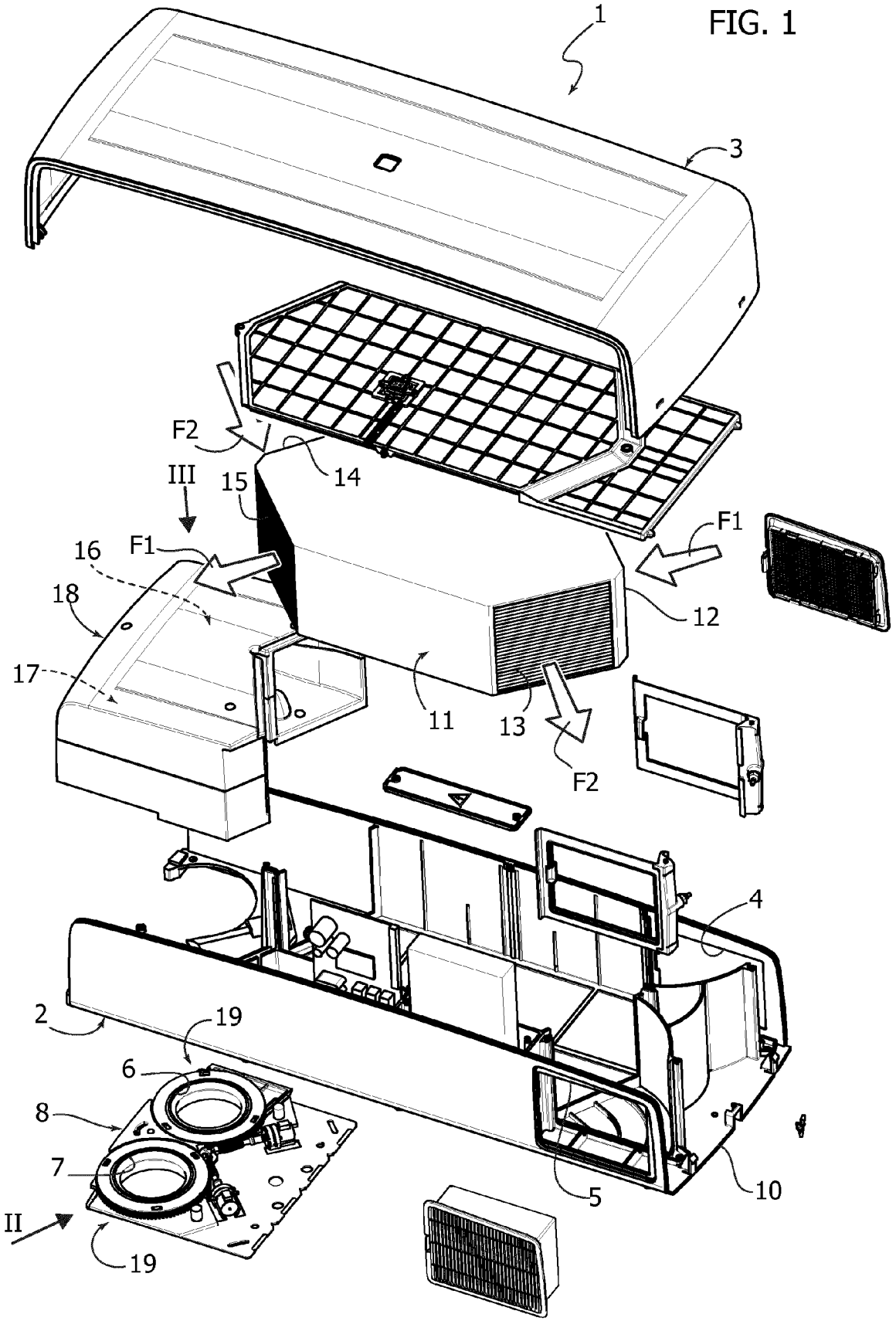


FIG. 2

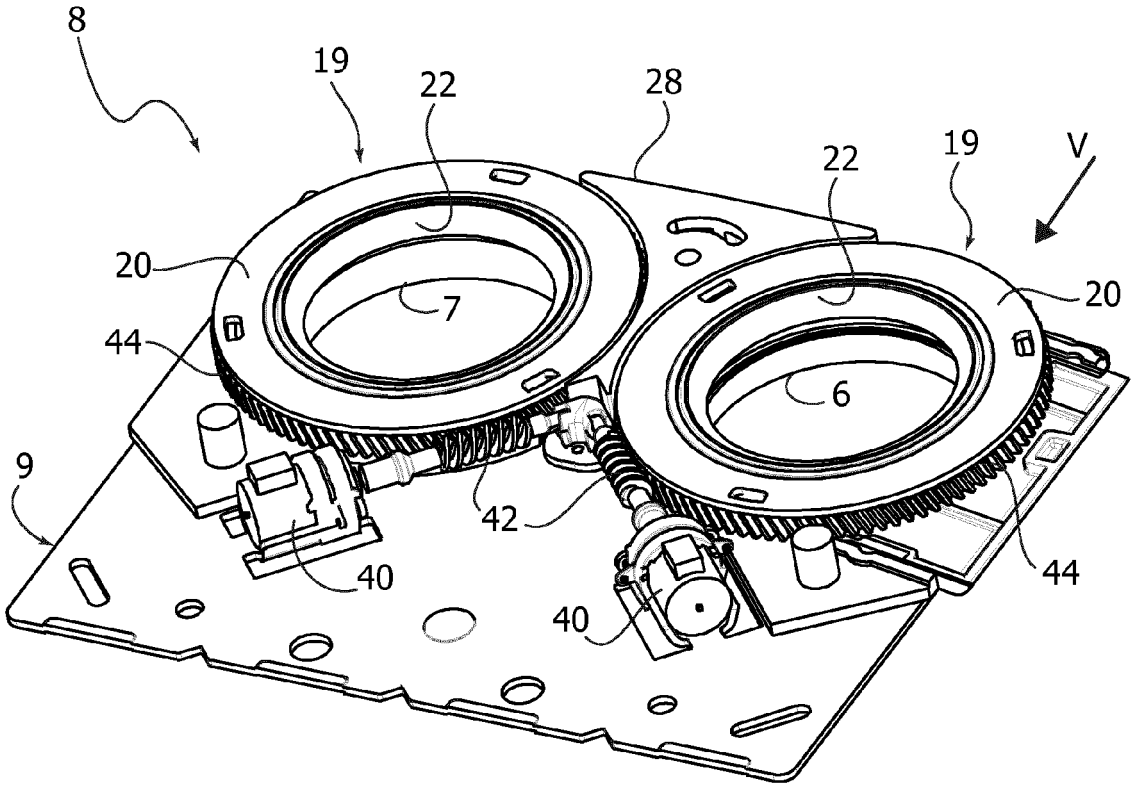


FIG. 3

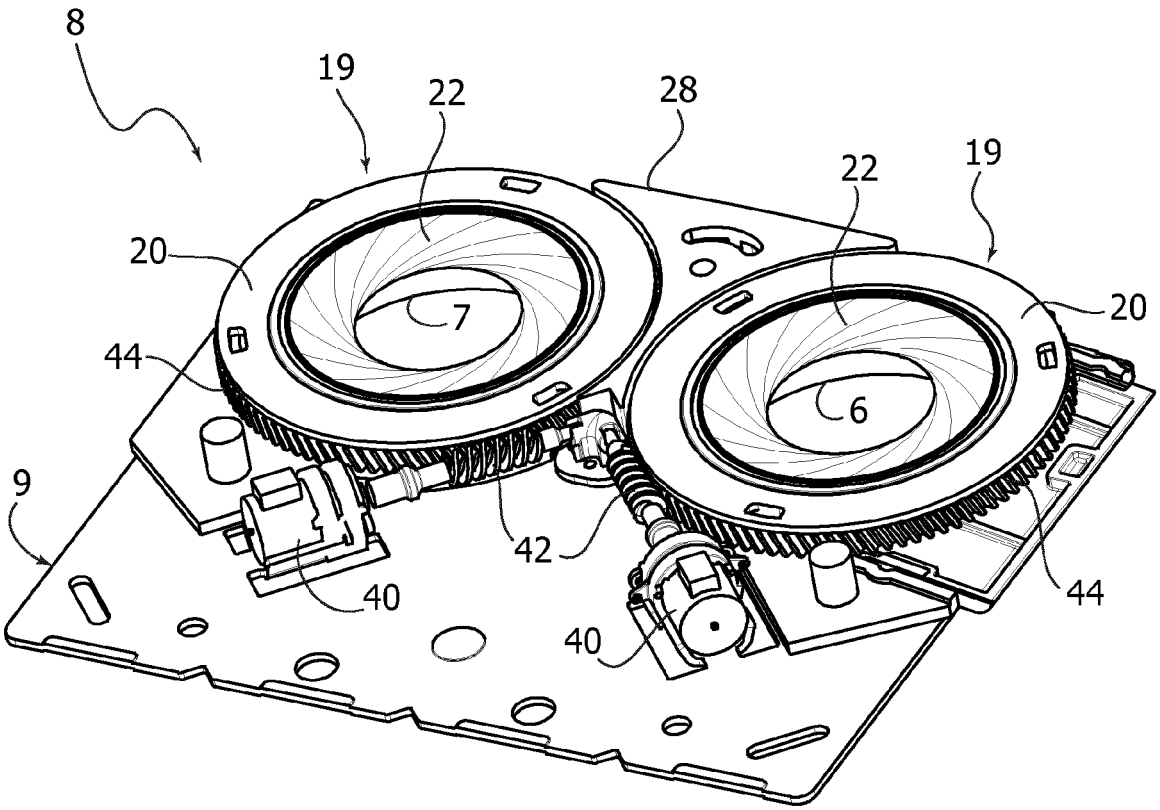


FIG. 4

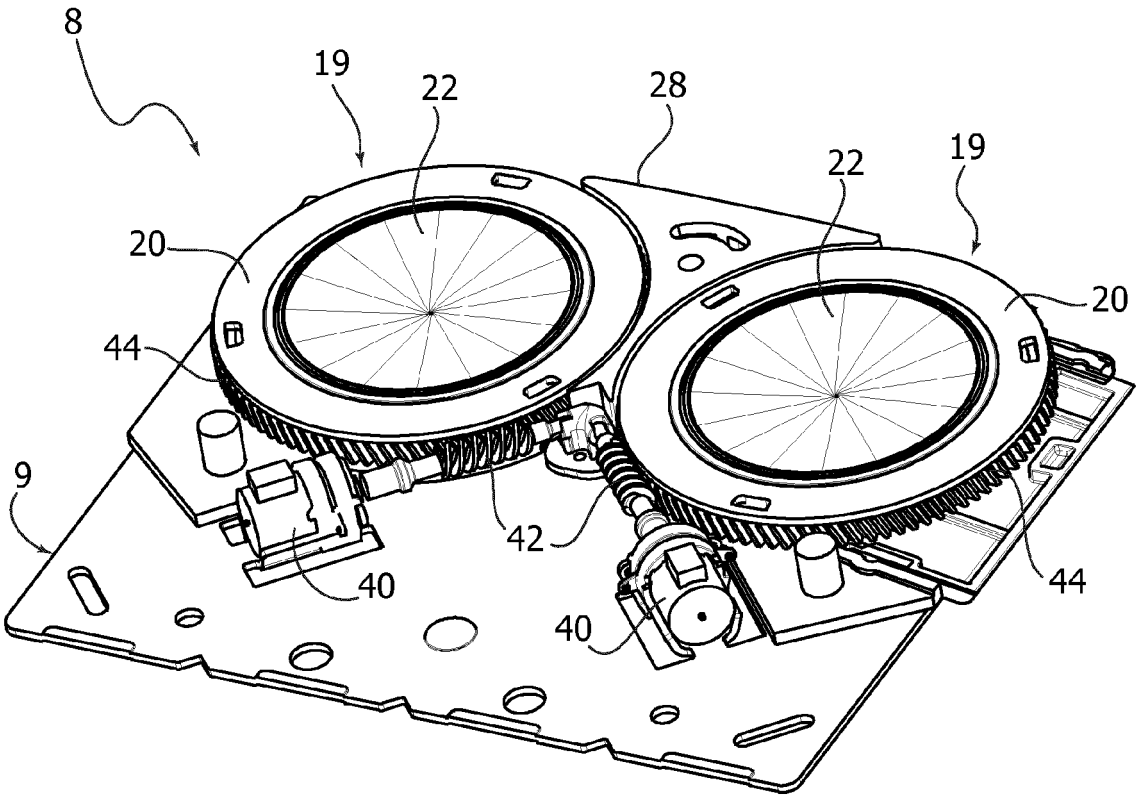


FIG. 5

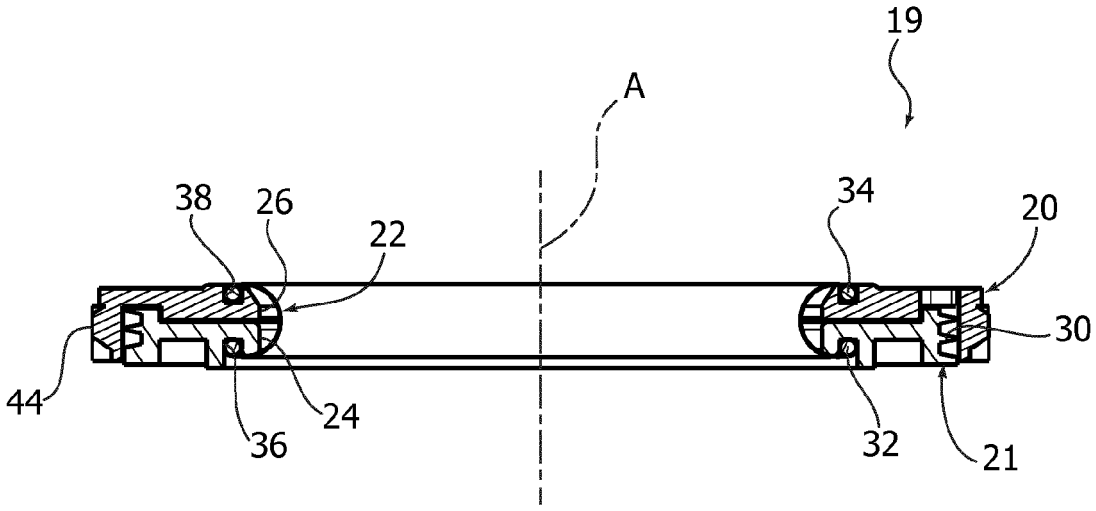
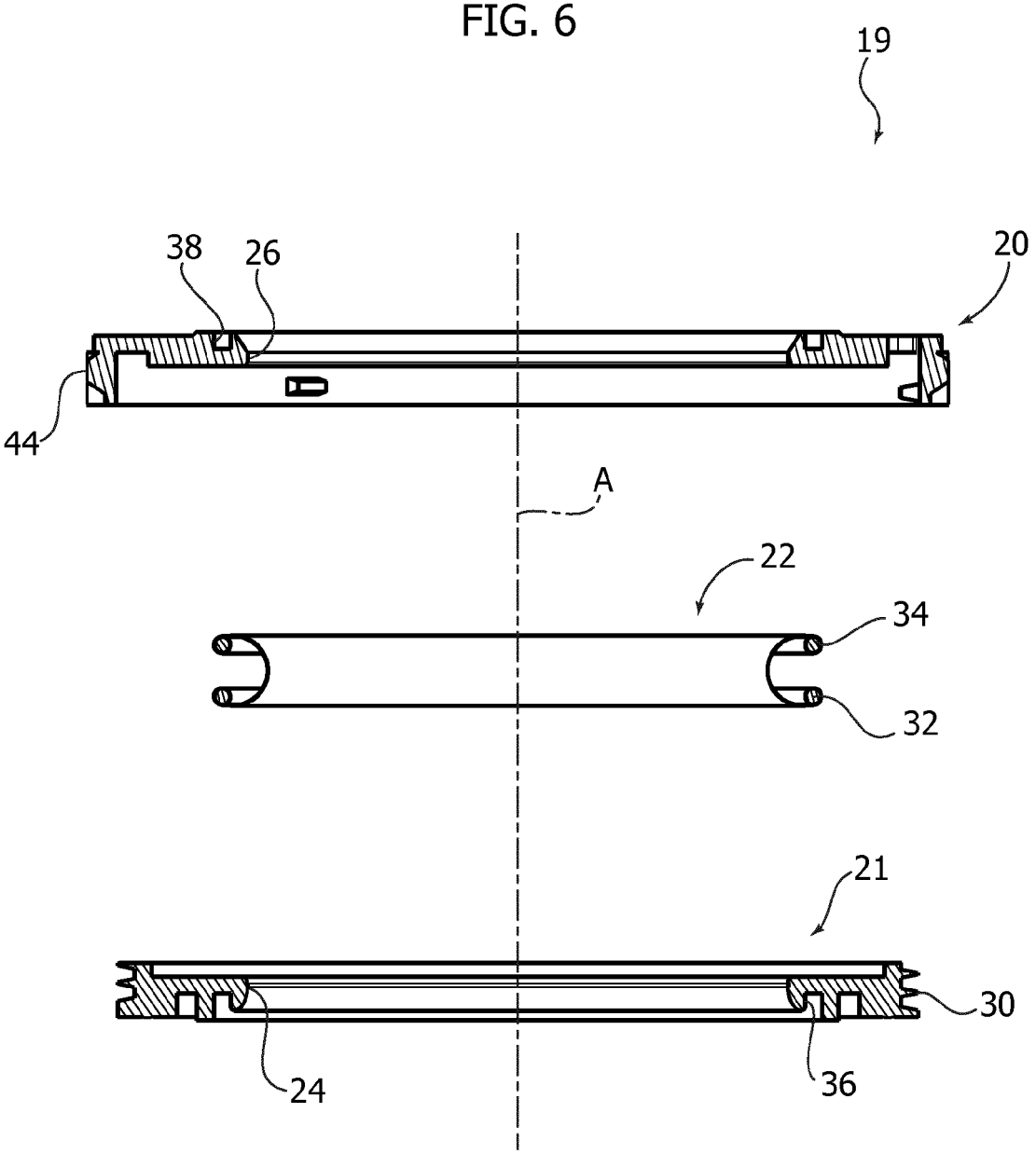


FIG. 6



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 19 8161

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 407 727 A2 (TROGES GMBH [AT]) 18 January 2012 (2012-01-18) * abstract * -----	1-3	INV. F24F12/00 F24F13/10
A	EP 0 114 241 A2 (GRETSCH UNITAS GMBH [DE]) 1 August 1984 (1984-08-01) * abstract * -----	1-3	
A	US 1 407 216 A (DAY POTTER LAUREUS) 21 February 1922 (1922-02-21) * abstract * -----	1-3	

TECHNICAL FIELDS SEARCHED (IPC)
F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 April 2014	Valenza, Davide

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 19 8161

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-04-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2407727 A2	18-01-2012	AT 510003 A4	15-01-2012
		EP 2407727 A2	18-01-2012
EP 0114241 A2	01-08-1984	DE 8301708 U1	09-06-1983
		EP 0114241 A2	01-08-1984
		JP S59137737 A	07-08-1984
		US 4557321 A	10-12-1985
US 1407216 A	21-02-1922	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82